TABLE 1.—*Solar radiation intensities during July, 1929*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C

Date	Sun's zenith distance: 8 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th meridian time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
July 3	7.57	0.77	0.82	0.92	1.12	1.32					6.50
July 8	19.89					1.11					17.37
July 10	17.37				0.94	1.22					15.11
July 13	15.11			0.54							14.60
July 16	11.81		0.78	0.90	1.01	1.31					10.21
July 17	12.24	0.78	0.90	1.03	1.17	1.32	1.00	0.81			9.14
July 31	13.13				0.84	1.20					14.10
Means		(0.78)	(0.83)	0.85	1.02	1.25	(1.00)	(0.81)			
Departures		+0.20	+0.17	+0.08	+0.12	+0.07	+0.02	+0.03			

Madison, Wis.

July 2	7.87		0.88	1.00	1.15	1.36					9.83
July 5	10.97				1.07						14.10
July 9	13.61				1.15	1.42					11.81
July 10	9.83	0.77	0.88	1.00	1.13	1.37					11.38
July 15	9.83					1.27	1.07				10.21
July 16	9.14					1.12	1.04				12.68
July 18	11.38			0.92	1.08	1.27					13.61
July 19	7.29		0.86	1.02	1.17	1.37	1.17				7.29
July 25	16.20			0.89	0.94						17.37
July 30	11.81				1.12	1.35					13.13
July 31	13.13			1.00	1.15	1.31					15.65
Means		(0.77)	0.87	0.97	1.11	1.32	1.09				
Departures		+0.12	+0.09	+0.07	+0.06	+0.04	+0.08				

Lincoln, Nebr.

July 2	11.38					1.15	0.97	0.79	0.67	0.56	7.87
July 18	13.61						1.04	0.85	0.74		9.47
July 20	10.97		0.61	0.74	0.98	1.20					13.13
July 21	12.68		0.50								15.65
July 25	16.20			0.77	0.95	1.22					16.20
July 26	15.65		0.63	0.79	0.98						14.10
July 27	14.10		0.79	0.92							15.11
Means			0.63	0.80	0.97	(1.19)	(1.00)	(0.82)	(0.70)	(0.56)	
Departures			−0.15	−0.09	−0.11	−0.14	−0.06	−0.06	−0.04	−0.11	

[1] Extrapolated.

TABLE 2.—*Solar and sky radiation received on a horizontal surface*

[Gram-calories per square centimeter of horizontal surface]

Week beginning—	Average daily radiation: Washington	Madison	Lincoln	Chicago	New York	Twin Falls	Fresno	La Jolla	Average daily departure from normal: Washington	Madison	Lincoln	Chicago	New York
1929	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
July 2	643	491	529	373	427	851	721	390	+142	−42	−49	−103	+17
July 9	533	501	404	378	417	811	740		+51	−30	−166	−39	+12
July 16	561	574	583	512	368	767	710	485	+85	+63	+13	+95	−34
July 23	563	516	569	359	362	764	681	481	+85	+23	+30	−51	−35
Excess or deficiency since first of year on July 30									+3,150	−1,148	−1,832	−819	−3,899

RECORDS OF THE TOTAL SOLAR RADIATION (DIRECT + DIFFUSE), RECEIVED ON A HORIZONTAL SURFACE IN SOUTHERN CALIFORNIA

By H. H. KIMBALL

In a recent letter Mr. Burt Richardson transmits the solar radiation values given in Tables 1_a and 1_b. Those given in Table 1_a were obtained from automatic records made by a Weather Bureau type of thermoelectric pyrheliometer recording on an Engelhard microammeter, type S–1. Those given in Table 1_b were computed by Richardson from the rates of evaporation measured in a pan by a method described in a paper by himself and Carol Montgomery jointly.[1]

These records of the total solar radiation (direct + diffuse), received on a horizontal surface are of special interest. They are the first measurements of the kind received from southern California, and they afford an opportunity to compare computed with measured results.

The recording pyrheliometer is now in continuous operation at La Jolla, and Mr. Richardson has kindly agreed to furnish weekly averages each month for publication in the MONTHLY WEATHER REVIEW in Table 2 under Solar Observations.

The pyrheliometer is installed on the top of an elevated water tank, where it has free exposure to sun and sky except for hills to the east which cut off the early morning rays of the sun when the sky is free from cloud and fog. Early morning fogs are frequent at certain seasons of the year.

TABLE 1_a.—*Daily totals of solar radiation (direct + diffuse), received on a horizontal surface at Scripps Institution of Oceanography, La Jolla (San Diego), Calif. Lat. 32.87° N., long. 117.25° W.*

Date	1929: Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	1928: Dec.
1	305	157	424	510	557		662					320
2	291	337	373	397	540		627					209
3	251	329	433	412	531		669					106
4	262	277	433	208	507		679					305
5	302	266	334	432	389		621					107
6	141	77	262	538	520		614				331	322
7	284	149	310	532	521		610				298	296
8	281	170	363	493	496		591				312	308
9	256	376	306	389	552		666				359	305
10	313	374	201	534	555		605				322	182
11	314	381	405	511	576		587				333	298
12	344	373	362	481			472				300	226
13	300	384	442	499	456		433				296	305
14	250	289	354	537	317		634				127	317
15	67	365	402		475		571				308	296
16	207	384	369	455	318		601				298	293
17	294	211	202	322			604				344	296
18	257	183	209	288			580					315
19	138	375	429	391			632					301
20	231	395	418	499			482				300	283
21	251	384	251	472			534					306
22	312	391	143	433			433				317	305
23	199	256	372	518			354				201	307
24	346	404	495	495			276				197	304
25	323	304	497	429			238				381	300
26	332	404	535	189			517				345	295
27	172	425	547	332			592				123	123
28	320	423	415	259			489				376	293
29	330		343	485			475				338	281
30	207		219	522			410				356	303
31	106		461				579					314
Monthly means	264	316	365	433	487	504	545				298	275

MONTHLY MEANS FOR PASADENA, CALIF., LAT. 34° 15′ N., LONG. 118° 17′ W

1926–1928	302	383	427	532	568	512	582	568	490	400	365	316

TABLE 1_b.—*Computed monthly mean daily totals of solar radiation*

San Diego, Calif. Computed by *Pan* method	662
La Jolla, Calif. Computed by *Pan* method	545

[1] The measurement of insolation by means of a pan. Bulletin of the National Research Council, No. 68, p. 56, Washington, 1929.

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
	h. m.	°	°	°			
July 27 (Naval Observatory).	10 49	−24.0	33.5	−22.0		170	
		−7.5	50.0	−12.5		154	
		+10.0	67.5	+6.5	46		370
July 28 (Naval Observatory).	10 46	−12.5	31.8	−22.5		108	
		+7.0	51.3	−12.0		170	
		+22.5	66.8	+6.5	40		318
July 29 (Naval Observatory).	10 50	−22.0	9.0	+9.5	3		
		+2.5	33.5	−21.0		154	
		+22.0	53.0	−10.5		123	
		+36.0	67.0	+7.5	31		311
July 30 (Naval Observatory).	10 46	−74.5	303.3	+6.9	9		
		−37.0	340.8	+21.0		12	
		−30.0	347.8	−8.0	9		
		−4.5	13.3	+3.0	3		
		+10.0	27.8	+30.0	3		
		+16.0	33.8	−20.5		170	
		+36.0	53.8	−10.5		93	
		+50.0	67.8	+7.0	37		336
July 31 (Naval Observatory).	10 46	−75.5	289.1	−3.5		154	
		−30.0	334.6	−8.0	3		
		−23.0	341.6	+21.5		46	
		+29.0	33.6	−20.5		123	
		+50.0	54.6	−10.5	62		
		+63.0	67.6	+7.5	31		419
Mean daily area for July							715

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR JULY, 1929

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

July, 1929	Relative numbers	July, 1929	Relative numbers	July, 1929	Relative numbers
1	71	11	[3] 95	21	100
2	82	12	79	22	78
3	86	13	86	23	63
4	[1] 65	14	[3] 76	24	E [2] 50
5	W [2 3] 67	15	[3] 92	25	40
6	[4] 68	16	88	26	M [2] 46
7	79	17	[4] 70	27	67
8	73	18	70	28	[1] 58
9	M [2] 57	19	73	29	[4] 45
10	[4] 73	20	[1] 73	30	E [2] 43
				31	[3] 60

Mean (31 days) = 70.1.

[1] = Passage of an average-sized group through the central meridian.
[2] = New formation of a large or average-sized center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.
[3] = Entrance of a large or average-sized center of activity on the east limb.
[4] = Passage of a large group through the central meridian.

AEROLOGICAL OBSERVATIONS

By RICHMOND T. ZOCH

Free-air temperatures were below normal at all levels at Broken Arrow and Due West and above normal at Ellendale and Washington. (See Table 1.) The inverse relationship found between the temperature and relative humidity departures is exceptionally striking.

Free-air vapor pressure departures were variable and of small magnitude. This fact is self-explanatory on account of the inverse relation of the temperature and humidity departures. In agreement with the small vapor pressure departures, the total precipitation for the month was close to the normal at these stations, excepting Washington, where it was considerably below normal.

In the lower levels the resultant winds were southerly over practically the entire country. At the 3,000-meter level the resultant winds were easterly in the extreme Southern States and westerly over the remainder of the country. Above the 3,000-meter level they remained easterly in the extreme South but changed to northwesterly in the northeastern part of the country and to southwesterly on the Pacific coast.

The number of observations made (see Table 3) includes 4 captive balloon and 10 limited-height sounding balloon flights. These types of observations will probably be increasingly used.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during July, 1929*

TEMPERATURE (°C.)

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C. (Naval air station) (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters												
Surface	26.3	−0.3	24.8	−2.0	22.8	+1.8	25.3	−1.3	23.1	−1.8	26.5	+1.3
500	24.5	−0.4	21.8	−2.2	22.4	+1.8	24.1	+0.2	21.1	−1.0	23.2	+1.3
1,000	21.7	−0.5	19.3	−1.4	20.4	+2.4	21.3	−0.4	18.4	−0.2	20.7	+1.3
1,500	18.5	−0.7	16.6	−0.8	17.6	+2.0	18.4	−0.7	15.5	+0.1	17.9	+1.5
2,000	15.5	−0.7	13.4	−0.7	14.6	+1.7	16.8	+0.4	12.7	+0.2	15.1	+1.7
2,500	12.0	−1.1	10.1	−0.9	11.0	+1.0	14.1	+0.6	9.7	−0.1	12.2	+1.6
3,000	8.8	−1.1	6.7	−1.4	7.7	+0.6	11.5	+0.9	6.6	−0.5	9.2	+1.3
4,000			0.1	−2.3	2.5	+1.1			0.6	−0.9	4.8	+2.8
5,000											−2.3	+2.8

RELATIVE HUMIDITY (%)

Surface	72	+3	73	+6	59	−10	83	+8	73	+11	67	−4
500	71	+5	78	+9	59	−9	81	+4	72	+8	63	−5
1,000	70	+7	72	+2	51	−11	73	+6	71	+4	59	−5
1,500	68	+6	78	+6	51	−7	63	+1	71	+5	57	−8
2,000	62	+3	77	+5	51	−4	52	−7	61	−1	56	−10
2,500	66	+8	73	+2	51	−2	47	−11	55	−1	54	−10
3,000	62	+4	75	+6	51	0	42	−15	60	+10	52	−7
4,000			66	+3	47	−3			45	+4	33	−17
5,000											36	−17

VAPOR PRESSURE (*mb.*)

Surface	24.62	+0.59	23.00	−0.15	16.13	−0.98	26.57	+0.94	21.02	+1.53	23.52	+0.52
500	21.74	+0.79	20.46	+0.08	15.68	−0.86	23.94	+1.46	18.50	+1.49	18.06	+0.17
1,000	18.08	+1.05	16.13	−0.95	12.15	−0.69	18.76	+1.75	15.38	+1.01	14.68	+0.15
1,500	14.43	+0.59	14.74	+0.37	9.98	−0.31	13.44	−0.05	12.86	+1.31	11.91	−0.29
2,000	11.07	+0.11	12.01	+0.29	8.27	−0.01	9.57	−1.40	9.14	+0.29	9.92	−0.21
2,500	9.40	+0.60	9.08	−0.28	6.48	−0.23	7.41	−1.62	6.50	+0.01	7.83	−0.30
3,000	7.17	−0.01	7.39	−0.17	5.46	+0.06	5.62	−1.99	5.50	+0.63	6.15	−0.08
4,000			4.13	−0.68	3.73	+0.02			2.01	−0.81	2.29	−1.11
5,000											0.47	−1.11